

CUBAN CLIFF SWALLOW. *Petrochelidon fulva cavicola* Barbour and Brooks. Was found nesting in the caves under the Morro Castle at the entrance to Santiago Harbor. Considerable numbers were also seen at the Laguna del Sitio.

BLACK-WHISKERED VIREO. *Vireosylva calidris barbatula* Cabanis. Common.

BLUE HONEY CREEPER. *Cyanerpes cyaneus* Linne. One was seen at Hongolosongo on July 4.

CUBAN GOLDEN WARBLER. *Dendroica petechia gundlachii* Baird. Common in the mangroves at the head of Santiago Bay.

WEST INDIAN MOCKINGBIRD. *Mimus polyglottos orpheus* Linne. Abundant.

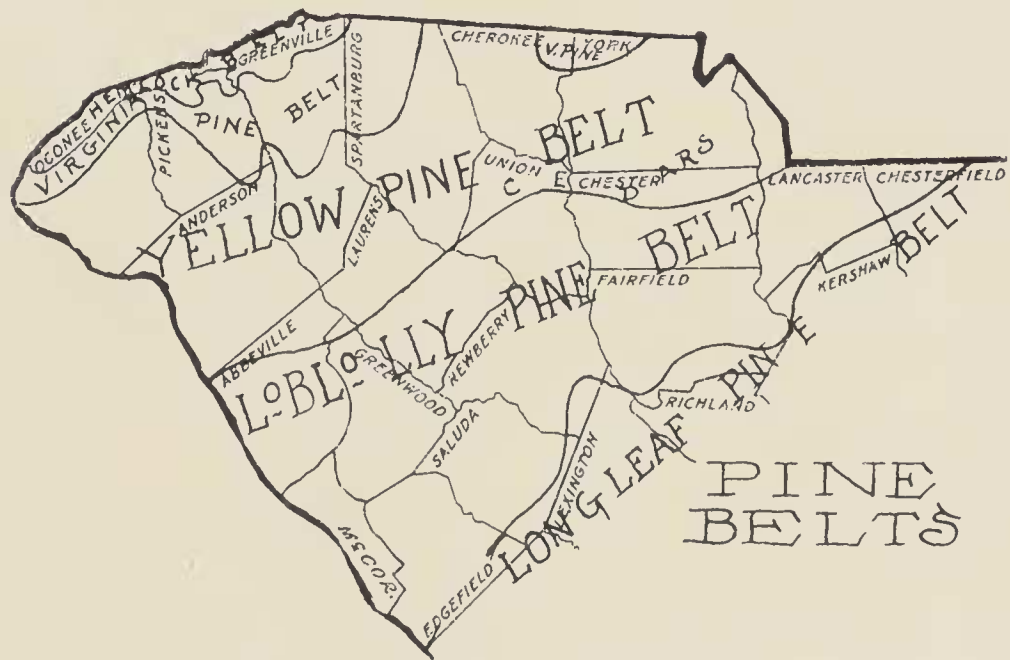
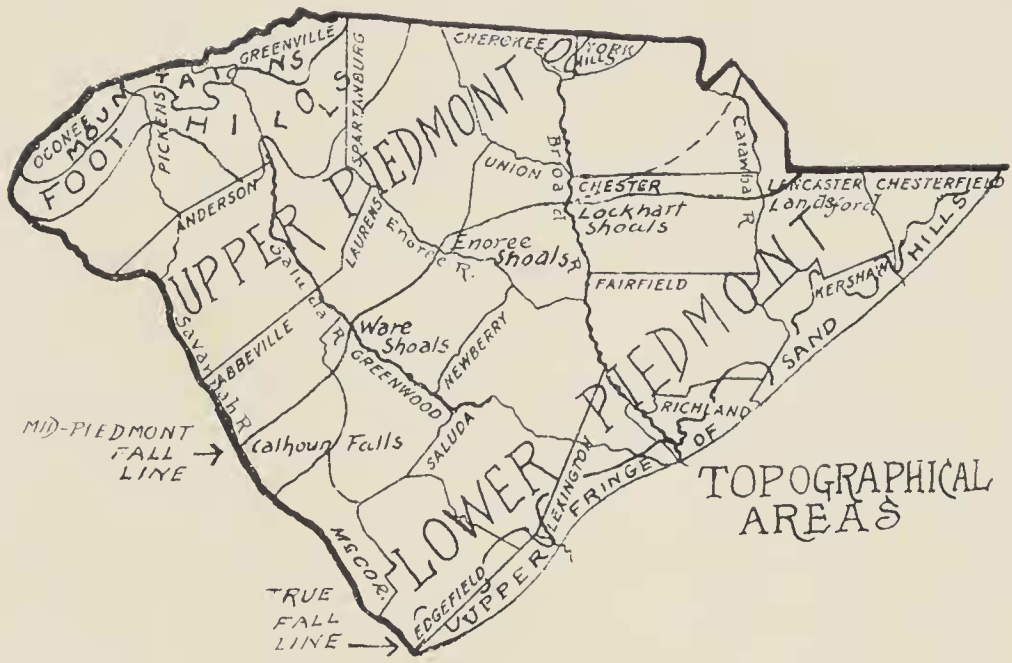
EASTERN CUBA THRUSH. *Mimocichla schistacea* Baird. These noisy birds were common in wooded hilly regions near El Cobre, Serafina and Hongolosongo.

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BIRDS OF UPPER SOUTH CAROLINA: A STUDY IN GEOGRAPHICAL DISTRIBUTION

BY A. L. PICKENS

The great Carolinian or Upper Austral (biological) Zone, which includes nearly all of the middle states, is joined to the Atlantic slope portion of the same zone, by a very narrow strip, that passes through the upper part of Georgia and South Carolina. Upper South Carolina, is that part of the state, between the Fall Line and the top of the first ridges of the Appalachians. The Fall Line is a geological boundary, marking the points at which the streams plunge over falls or shoals, in their descent from the hard rocks of the hill country to the softer sediments of the Tertiary formations of the Coast Plain. It runs through the central part of the state from Augusta, past Columbia, to the Yadkin or Peedee River near the North Carolina line. Above this natural boundary occur five distinct topographical belts, each with a preference, beyond that of neighboring zones, for some particular species of pine. First we have the Sand Hills featured by long-leaf pines; next comes the Lower Piedmont, with rocks of a slaty nature, and hills covered with loblolly pines. A secondary fall line occurs at river-bed elevations of about four hundred feet, where the streams drop from the granitic region into the slate regions, and then we find the Upper Piedmont with yellow pines. Still higher, at general eleva-



tions of 900 to 1000 feet, comes the Foot-hill Belt, with Virginia or Jersey pines more common than elsewhere, and then the hardwood covered mountains with Hemlocks scattered through their ravines.

These topographical belts, and the pine belts too, are traceable into the adjoining states. In warmer Georgia, however, the long-leaf and the loblolly pines are inclined to climb to higher altitudes, above the shelves occupied in South Carolina, and in cooler North Carolina to drop below them.

In round numbers, four hundred vertebrate forms have been catalogued from Upper South Carolina, including 49 fishes, 41 amphibians, 44 reptiles, and 36 mammals. Birds exceed all other vertebrates in approximate proportion of 9 to 7, and all other air-breathing vertebrates by more than 2 to 1. They are of course the most important group, in determining the boundaries of biological zones. The forms recorded for this part of the state are here given.

For some time a few workers in the upper parts of Georgia and South Carolina have been impressed with the number of species, typically of the Lower Austral Zone, that occur within the very shadows of the mountains, though the fourth Provisional Zone Map of the U. S. Biological Survey, shows nearly all of Georgia and South Carolina, above the Fall Line, as being in the Upper Austral Zone. Working with an older list of diagnostic species I decided that the Yellow Pine Belt was barely Carolinian, or Upper Austral, so placing the upper limit of the Lower Austral along the upper limit of the loblolly pine's range. Not thoroughly satisfied, and possibly feeling I was getting too far north, I wrote to Mr. A. H. Howard of the U. S. Biological Survey, and secured a more recent list of forms by which zones are traced. Among birds there were nine characteristic of the Lower Austral, and five of the Upper Austral. All the nine breed in the Sand Hills, and all of the five in the mountains! To show the relation by belts I constructed the following table:

	Sand Hills	Lower Piedmont	Upper Piedmont	Foot-hill Belt	Alpine Belt
Upper Austral forms.....				3	5
Lower Austral forms.....	9	8	1	2	

Another name for the Upper Austral is Carolinian, and I was surprised to find these researches had almost driven the Carolinian claim from South Carolina, only four of her forty-four counties showing the Carolinian, and these only in their higher reaches! Mammalian, reptilian, amphibian, and botanical forms are found that tend to support these conclusions. Lung-breathers carry the battle line of the Lower Austral upward into the highlands, but gill-breathers

coming down the streams make the waters more northerly in character. Following the map that represents this as an Upper Austral area, I have elsewhere, in cataloging the fishes, remarked that they made up a group more related to northern than southern regions, and more consistent with the Carolinian Zone. I have been reminded, however, that fish, influenced by the coolness of mountain streams, are frequently found in the next zone below their proper one. This would of course hold with water-dwelling salamanders, of which we have found several forms well-down into the Piedmont.

To set hard and fast boundaries between the biological zones is, of course, impossible. They apparently shift from time to time, a hot, dry summer favoring the Lower Austral forms, a cool, wet one the Upper forms. The zone notations given above are chiefly from Chapman's Handbook. Counting all available records, the number of species from the Upper Austral Zone are in the lead, even in the Upper Piedmont, but some of these are for single nesting records, and some now appear to have been driven to the mountains by deforestation, whereas most of the recorded Lower Austral forms are constant, and often abundant as to individuals. From the quandary escape is offered in Mr. Howard's diagnostic list, for four Lower Austral and no Upper Austral forms are now found in the higher Piedmont. In the Foot-hills three of the latter appear. It would seem that the Upper Austral, or Carolinian Zone has for its southern boundary in South Carolina, an indefinite limit, roughly following the Foot-hills from Oconee County to higher Spartanburg. In the upper Savannah Valley, it is squeezed against the Transition or Alleghanian Zone in the vicinity of Rabun Mountain. At one place it is apparently a mere wasp-waist of fifteen or twenty miles. This narrow tie is all that holds the Carolinian territory of Iowa, Kansas, southern Ontario and Tennessee to that of New Jersey and Long Island. Slightly to the east of this point, in Pickens and Transylvania Counties, one may, inside of two counties and in a width of forty miles, travel in all the great biological zones between the Gulf of Mexico and the Gulf of Saint Lawrence!

All published records, heretofore, have been vague on the matter of the zone boundaries in this state. Cope, in 1875 and again in 1898, in his "Geographical Distribution," says of the Upper Austral or Carolinian Zone, "It embraces a wide belt in Maryland and Virginia, and all of central North Carolina, and then narrows very much in passing round south of the Allegheny Mountains of Georgia." Loomis, in 1890, in his *Auk* series on the Summer Birds of Pickens County re-

marks, "Three avifaunae meet in the South Carolina highlands—the Louisianian, Carolinian and Alleghanian. The first named is not prominent, the local ornithology being characterized by species representative of the Carolinian and Alleghanian, those of the former preponderating. In his Birds of Chester County series published in the Nuttall Bulletin and in the *Auk*, he says in 1891 of Chester County, "The general character of the fauna is Louisianian. The near proximity of the mountains exerts a modifying influence upon it, lessening the force of the Louisianian, however, rather than bringing into marked prominence the Carolinian."

To what extent these pine belts could be used in determining sub-zones of bird and other life I cannot say, but I have found them of value in South Carolina and Georgia. Certainly the long-leaf pine gives good evidence of the Lower Austral, and the loblolly a slightly toned-down belt of the same, so long as we keep to these latitudes. Further north along the coast, however, they are found to Cape May, beyond their wonted zone. It is possible, though, that southern New Jersey would be Lower Austral but for the wide breaks of the Chesapeake and Delaware. Yellow pines are found from mountains to sand hills, but are more dominant in the Upper Piedmont. The Virginia pines are also found below their belt, but being lovers of thin sterile steeps, they become more conspicuous in the worn fields of the foot hills. From there on the hardwood forests become more pronounced, and Carolinian forms seem to prefer such. The Hemlocks of the Alpine area are safely indicative of Upper Austral.

The foot-hills of the famous Kings Mountain Range, while very low, add an alpine touch in Cherokee and York, with a wide spray of more Jersey pines. Perhaps such an outlying area is to be regarded more in the nature of the patches of such trees found on steep river banks, even in the Loblolly Belt, rather than as part of the Jersey Pine Belt, recognized by lumbermen and dendrologists. This same range disrupts the topography, elevating part of the slate area, normally Lower Piedmont in character, to higher levels. The wide valleys of the Broad and Savannah Rivers, also offers avenues for the mingling of forms from the different belts. This difference between belts is noticeable, not only among summer breeders, but among winter visitors and residents.

I am grateful to Mr. A. H. Howard for aid in tracing the approximate zone boundary, and for various forms of aid from Messrs. Gabriel Cannon, P. M. Jenness, Franklin Sherman, Thomas Smyth, Wm. Hahn, Jr., E. R. Blake, G. E. Hudson, Arthur Wayne, Joseph

Ledbetter, and Miss Mary Baughan of South Carolina; Messrs. T. D. Burleigh, E. R. Greene, and G. A. Dorsey of Georgia; Mr. W. L. McAtee of Virginia; Mr. C. J. Pennock of Pennsylvania; the late Mr. L. M. Loomis of California, the Boston Museum of Natural History, the Charleston Museum, and more than a hundred college and other students.

[The following list contains 220 named forms.—Ed.]

HORNED GREBE. *Colymbus auritus*. One taken by Loomis at Chester, March 4, 1880.

PIED-BILLED GREBE. *Podilymbus podiceps*. Fairly common yearly resident.

COMMON LOON. *Gavia immer*. Occasional in winter on larger bodies of water.

RED-THROATED LOON. *Gavia stellata*. I have seen this form only on the coast, but Loomis records a specimen for Chester, February 28, 1885.

BRUNNICH'S MURRE. *Uria lomvia lomvia*. Accidental at Anderson. One taken by J. R. Nowell and brother, December 19, 1896. Recorded by Elliott Coues in the *Auk*.

HERRING GULL. *Larus argentatus*. Around larger bodies of water occasionally.

BLACK TERN. *Chlidonias nigra surinamensis*. One, taken on Saluda in upper Piedmont, was mounted by David Smith of Greenville, S. C.

BLACK SKIMMER. *Rynchops nigra*. Accidental at Chester, September 10, 1880. By Loomis.

YELLOW-BILLED TROPIC-BIRD. *Phaethon americanus*. Accidental at Jocassee in the mountains, July 30, 1926. Recorded in the *Auk* by A. T. Wayne and F. Sherman.

HOODED Merganser. *Lophodytes cucullatus*. Winter resident in lower Piedmont.

MALLARD. *Anas platyrhynchos*. Common winter resident.

BALDPATE. *Mareca americana*. Winter resident in lower Piedmont.

GREEN-WINGED TEAL. *Nettion carolinense*. Winter resident.

BLUE-WINGED TEAL. *Querquedula discors*. Common winter resident.

SHOVELLER. *Spatula clypeata*. In winter in lower Piedmont.

PINTAIL. *Dafila acuta tzitzihoa*. One record from Loomis at Chester, March 12, 1883, and recently recorded near Greenville by myself.

WOOD DUCK. *Aix sponsa*. Resident throughout the year.

REDHEAD. *Marila americana*. In winter in lower Piedmont.

LESSER SCAUP DUCK. *Marila affinis*. Winter resident.

RING-NECKED DUCK. *Marila collaris*. Winter resident.

BUFFLE-HEAD. *Charitonetta albeola*. In lower Piedmont in winter.

RUDDY DUCK. *Erismatura jamaicensis*. Recorded near fall-line by Dr. Thos. Smyth, in the *Auk*, April, 1926, but not taken.

CANADA GOOSE. *Branta canadensis canadensis*. Fairly common in winter.

WHISTLING SWAN. *Cygnus columbianus*. All records from lower Piedmont.

WOOD IBIS. *Mycteria americana*. Recorded only near the fall-line.

AMERICAN BITTERN. *Botaurus lentiginosus*. Winter resident.

LEAST BITTERN. *Ixobrychus exilis*. Summer resident and breeder. Mr. Wm. Hahn, Jr., found a nest near Greenwood in May, 1923.

GREAT BLUE HERON. *Ardea herodias herodias*. Found in summer even in the mountains, and in lower Piedmont in winter.

EGRET. *Casmerodius egretta*. Recorded by Loomis in lower Piedmont. Not common.

LITTLE BLUE HERON. *Florida caerula*. Young white birds are seen in summer to the foot of the mountains. The blue and mixed phases I have found later in the summer below the fall-line.

LITTLE GREEN HERON. *Butorides viriscens viriscens*. Common in summer.

BLACK-CROWNED NIGHT HERON. *Nycticorax nycticorax naevius*. Rather common in spring and autumn, and fairly so during summer.

KING RAIL. *Rallus elegans*. Summer resident; not very common. Wm. Hahn, Jr., found nests in the lower Piedmont near Greenwood, in 1924 and 1926.

VIRGINIA RAIL. *Rallus virginiana*. Winter resident.

SORA. *Porzana carolina*. Migrant.

YELLOW RAIL. *Corturnicops noveboracensis*. Migrant in lower Piedmont.

BLACK RAIL. *Cresciscus jamaicensis*. One found by Loomis, Chester, September 3, 1887.

FLORIDA GALLINULE. *Gallinula chloropus cachinans*. Summer resident.

COOT. *Fulica americana*. Found during migration in both upper and lower Piedmont.

NORTHERN PHALAROPE. *Lobipes lobatus*. Accidental at Chester, May 17, 1880. (Loomis).

WOODCOCK. *Rubicola minor*. Yearly resident; not common.

WILSON'S SNIPE. *Gallinago delicata*. Winter resident; common during migrations.

PECTORAL SANDPIPER. *Pisobia maculata*. Two recorded for Chester by Loomis, October 10, 1878.

LEAST SANDPIPER. *Pisobia minutilla*. Recorded as migrant by Loomis at Chester.

GREATER YELLOW-LEGS. *Totanus melanoleucus*. Seven at Chester, April 21, 1880.

YELLOW-LEGS. *Totanus flavipes*. One recorded, August 8, 1877, by Loomis as Chester.

SOLITARY SANDPIPER. *Tringa solitaria solitaria*. Common migrant in the lower Piedmont. Also found in summer.

UPLAND PLOVER. *Bartramia longicauda*. Migrant in lower Piedmont, and perhaps less frequently near the mountains.

SPOTTED SANDPIPER. *Actitis macularia*. Chiefly a spring migrant; less common in the fall; in mountains, about ponds, during summer. I noted it about an artificial lake near Little Rich Mountain in July, 1927.

GOLDEN PLOVER. *Pluvialis dominica dominica*. One was taken by Loomis, at Chester, September 19, 1877.

KILLDEER. *Oxyechus vociferus*. Common throughout the year.

BOB-WHITE. *Colinus virginianus virginianus*. Common yearly resident.

RUFFED GROUSE. *Bonasa umbellus umbellus*. Yearly resident in the mountains, where it has been more or less restricted by deforestation of the lower lands.

WILD TURKEY. *Meleagris gallopavo silvestris*. Quite extinct in upper South Carolina, except for some possible localities in the mountains.

ENGLISH RING-NECKED PHEASANT. *Phasianus colchicus x torquatus*. Introduced.

PASSENGER PIGEON. *Ectopistes migratorius*. Extinct. Once found in the mountains even in the summer; A. T. Wayne observed two pairs at Caesar's Head in the summer of 1882.

MOURNING DOVE. *Zenaidura macroura carolinensis*. Common yearly resident.

TURKEY VULTURE. *Cathartes aura septentrionalis*. Yearly resident; more common in mountains and upper Piedmont.

BLACK VULTURE. *Coragyps urubu*. Yearly resident. More common in lower hills.

SWALLOW-TAILED KITE. *Elanoides forficatus*. Rare, but general in summer.

MARSH HAWK. *Circus hudsonius*. Fairly common in winter in lower Piedmont.

SHARP-SHINNED HAWK. *Accipiter velox*. Yearly resident.

COOPER'S HAWK. *Accipiter cooperi*. Yearly resident, but commoner during the migrations and in winter.

RED-TAILED HAWK. *Buteo borealis borealis*. Yearly resident. Common.

RED-SHOULDERED HAWK. *Buteo lineatus lineatus*. Yearly resident. More common during migrations. The Florida variety, *B. l. alleni*, probably occurs in the lower Piedmont, a nest found by Mr. Hahn appearing to be of such a bird.

BROAD-WINGED HAWK. *Buteo platypterus*. Yearly resident. Mr. Hahn reports a nest near Greenwood, April 21, 1926.

GOLDEN EAGLE. *Aquila chrysaetes*. Occasional throughout territory, possibly still breeding in the mountains nearby.

BALD EAGLE. *Haliaeetus leucocephalus leucocephalus*. Occurs at times.

DUCK HAWK. *Falco peregrinus anatum*. Formerly bred in the mountains and may still do so.

PIGEON HAWK. *Falco columbarius columbarius*. Not a common migrant.

SPARROW HAWK. *Cerchneis sparveria sparveria*. Common yearly resident.

OSPREY. *Pandion haliaetus carolinensis*. Found along larger streams in summer even into the mountains.

BARN OWL. *Tyto alba pratincola*. Fairly common yearly resident. Chiefly reported from the lower Piedmont.

LONG-EARED OWL. *Asio otus wilsonianus*. Winter resident.

SHORT-EARED OWL. *Asio flammus*. Winter resident.

BARRED OWL. *Strix varia varia*. Yearly resident. Next to following, most common.

SCREECH OWL. *Otus asio asio*. Very common throughout the year. The Florida variety, *O. a. floridanus*, occurs along the Savannah into the lower Piedmont, according to Wayne.

GREAT HORNED OWL. *Bubo virginianus virginianus*. Once common, is being driven into the more heavily forested regions of the mountains and coast-plain.

SNOWY OWL. *Nyctea nyctea*. Occasional in the winter.

CAROLINA PAROQUET. *Conuropsis carolinensis*. Extinct.

YELLOW-BILLED CUCKOO. *Coccyzus americanus americanus*. Common in summer.

BLACK-BILLED CUCKOO. *Coccyzus erythrophthalmus*. A migrant which I have noted only in spring, one each in Anderson, Greenville, and Pickens Counties. Loomis records two at Chester. Coues, at Columbia, stated it was rarely seen.

BELTED KINGFISHER. *Ceryle alcyon*. Throughout year; more common in summer.

SOUTHERN HAIRY WOODPECKER. *Dryobates villosus auduboni*. Common yearly resident. This and the next, both Austroriparian, occur to the summit of the mountains.

SOUTHERN DOWNY WOODPECKER. *Dryobates pubescens pubescens*. Common yearly resident.

RED-COCKADED WOODPECKER. *Dryobates borealis*. Near fall-line. Austroriparian.

YELLOW-BELLIED SAPSUCKER. *Sphyrapicus varius varius*. Common winter resident.

PILEATED WOODPECKER. *Phloeotomus pileatus pileatus*. Common yearly resident. Another Austroriparian form occurring to the summit of the mountains.

RED-HEADED WOODPECKER. *Melanerpes erythrocephalus*. Common in summer, and found locally in the winter.

RED-BELLIED WOODPECKER. *Centurus carolinus*. Common in winter in Piedmont; not so often seen in summer, probably retiring to denser forests.

NORTHERN FLICKER. *Colaptes auratus luteus*. This form is found in the Piedmont even down to the fall-line, apparently blending in the lower Piedmont with the next following.

SOUTHERN FLICKER. *Colaptes auratus auratus*. Yearly resident.

CHUCK-WILL'S WIDOW. *Antrostomus carolinensis*. This Austroriparian form is common in summer, to the very foot of, and even into the valleys of the mountains.

WHIP-POOR-WILL. *Antrostomus vociferus vociferus*. Once common in summer in the Piedmont, deforestation is apparently pushing it back into the mountains where it breeds, occurring farther down the country as a migrant.

NIGHTHAWK. *Chordeiles virginianus virginianus*. Common summer resident.

[To be continued]